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CALIFORNIA MARINE PETROLEUM INFRASTRUCTURE

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Overview

California's downstream petroleum infrastructure consists of 11 major refineries, 8 small refineries, 32 major terminals of which 27 are marine facilities, 156 distribution terminals, and 4520 end-user owned storage facilities, including 34 military depots. Thousands of miles of pipelines connect the refineries to each other, to the marine docks and tanks, and to the inland distribution terminals.

This study limits itself to three major elements of the marine infrastructure. The first are waterfront refineries and/or terminals with tankage directly connected to docks capable of receiving petroleum tankers and barges ("marine oil terminals"). Second are terminals and refinery tankage that are located some distance inland but are connected to a marine dock by pipelines. The third element is the pipeline connections ("gathering systems") to the common carrier pipeline network. This analysis models the flow of waterborne products off of tankers into tankage at the dock (or pipelines connecting to tankage inland) and then into the pipeline network to distribute the product further.

California has two distinct refining centers, the Los Angeles Basin (LA Basin) and the Bay Area, and each of these refining centers has its own separate pipeline distribution network operated by Kinder Morgan. The two pipeline systems are not interlinked. Yet in many ways, the California market behaves as one and a fair amount of feedstocks and products are interchanged between the two refining centers, primarily by means of coastal barges, adding to the marine infrastructure requirements. For each of the main refining centers, an analysis of the available infrastructure is presented below.

Bay Area

The marine petroleum infrastructure in the San Francisco Bay area is concentrated in the northeastern parts of the Bay, in Richmond, the San Pablo Bay and the Carquinez Strait, and consists of five major refineries, one smaller refinery, and eight marine terminals. Three separate clusters exist, separated from each other by approximately 10 miles:

a) The ChevronTexaco refinery in Richmond and five terminals on the Richmond inner harbor operated by ARCO Terminal Services Co., IMTT, ST Services, Kinder Morgan, and Phillips (Tosco). A sixth marine terminal in Richmond, operated by Paktank and located on the Bay, could not renew its license and was shut down in 2000.

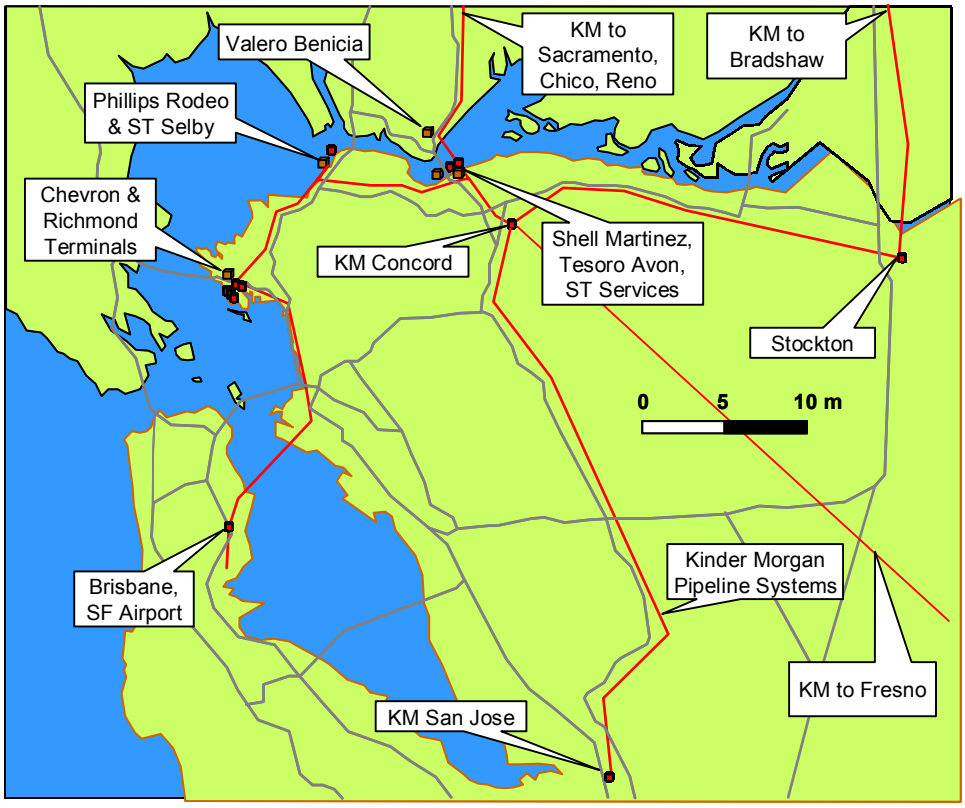
b) The ConocoPhillips Refinery in Rodeo, with the marine terminal of ST Services in Selby, near Crockett.

c) The Valero refinery (ex Exxon) on the north side of the Carquinez Strait, and the Shell refinery in Martinez on the south side, with the marine terminals of ST Services in Martinez and the Tesoro refinery and Amorco terminal in Avon.

These facilities are connected to the head of the Kinder Morgan Pipeline system at Concord. Products are distributed to the Bay Area, Northern California, Fresno, and Reno from Concord.

An overview of the Bay Area petroleum infrastructure is given in Figure 1.1 below.

Figure 1.1 - Bay Area Petroleum Infrastructure



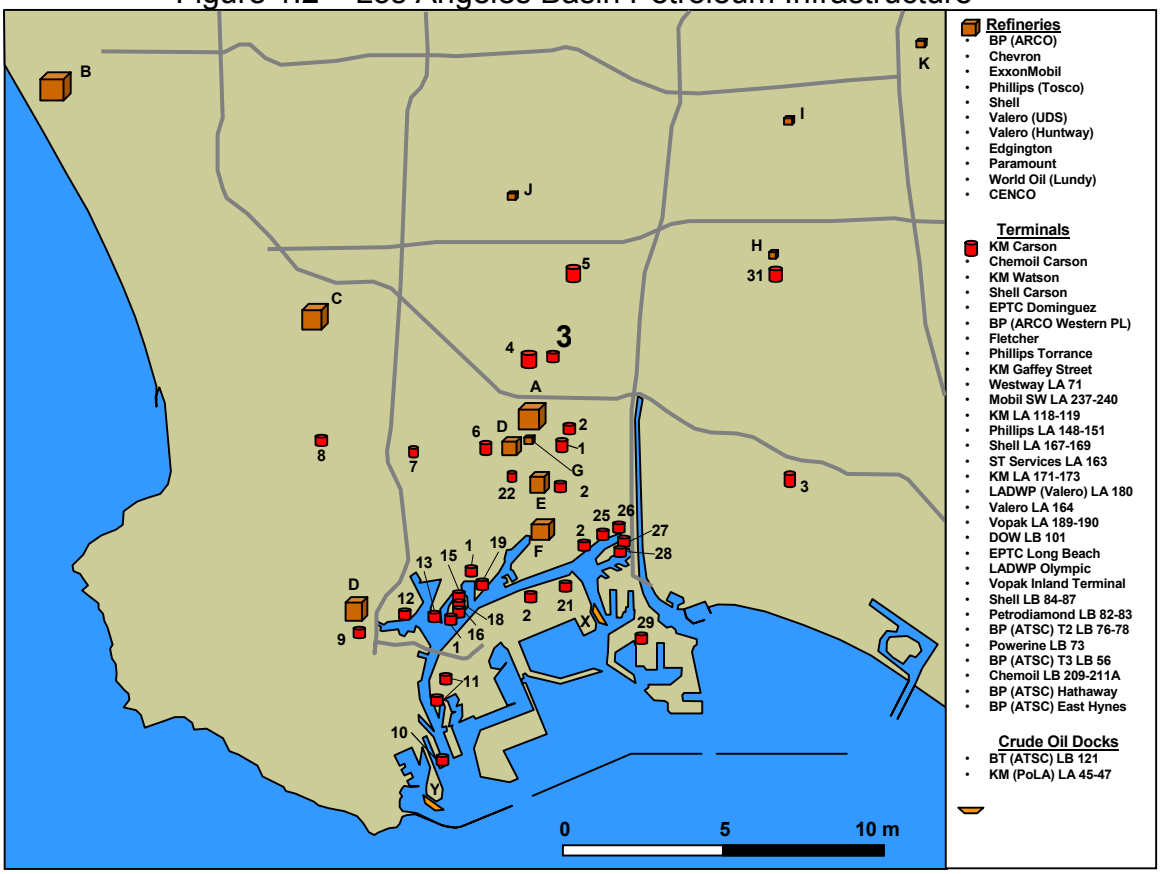
The Bay Area refiners and terminals are connected to each other by proprietary systems for clean products and black oil owned by refiners and ST Services, in addition to the Kinder Morgan pipeline systems that take products to Chico in the north, Reno in the east and Fresno to the south.

One of the key features of the marine terminals in the Bay Area is that for most sites, the draft of vessels is limited to 35 to 40 feet, with no single refinery or terminal capable of receiving a fully laden Very Large Crude Carrier (VLCC). Recently, the passage at Pinole Shoals has silted in to the point where draft is restricted to only 31.5 feet, restricting normal commerce up to Benicia, Martinez, Avon, Stockton, and Sacramento.

Los Angeles Basin

The marine petroleum infrastructure in the LA Basin is distinctly different from that in the Bay Area. Even though the Ports of Los Angeles and Long Beach are amongst the largest manmade harbors in the world, they are small in comparison to the natural harbor found in the San Francisco Bay. As a result, industrial waterfront property, which is already at a premium in the Bay Area, is even more valuable in Los Angeles. Many refineries and terminals that are part of the marine petroleum infrastructure in the LA Basin are actually located sometimes up to ten miles or more inland and connected to the dock by pipelines with sufficient capacity to achieve reasonable unloading rates.

Figure 1.2 – Los Angeles Basin Petroleum Infrastructure



Pipelines interconnections are not shown due to their complexity at this scale

All the refineries and most of the major terminals are connected to the Kinder Morgan pipeline system. The head of the Southern California pipeline system is at Watson, shown as terminal number 3. The pipeline delivers gasoline, jet fuel and diesel to San Diego, Colton, Barstow, Las Vegas, Imperial, Phoenix, and Tucson.

The trend in the Ports of Los Angeles and Long Beach over recent years has been to favor shorefront land use for containers and car imports, at the expense of bulk

liquid terminals. The need to create mega-terminals for container handling, with footprints in excess of 500 acres, has forced the ports to rethink the land use. As a consequence, several marine petroleum terminals have lost tankage or have been closed altogether. The increasing trend to have the tankage separated from the docks by 5 to 10 miles of pipelines poses a set of constraints on the handling capabilities of the marine petroleum infrastructure in the LA Basin that is unique.

As can be seen in Figure 1.2, the Los Angeles refining industry is concentrated north of the port, some 2 to 5 miles inland. Exceptions are ChevronTexaco El Segundo, whose refinery is located on the Santa Monica Bay and ExxonMobil with its refinery in Torrance. Except for some large distribution facilities, most terminals are located in the port, with notable concentrations on Mormon Island in the Port of Los Angeles and the eastern end of the Cerritos Channel in Long Beach.

Approach

The approach taken by Stillwater and the California Energy Commission (Energy Commission) for this study was to:

a) Define marine petroleum infrastructure and focus on the two key refining centers in the Bay Area and the Los Angeles Basin.

b) Use available data from the State Lands Commission to compile a complete inventory of available marine petroleum infrastructure and product movements.

c) Integrate the data from the State Lands Commission with other public and private information obtained through stakeholder interviews and review of publicly available information, for instance, data regarding capacities for pipelines linking inland terminals to marine docks.

d) Evaluate the handling capacity of California's infrastructure based on industry practices and generally accepted engineering criteria, such as allowable jetty occupancy, number of turnovers of tanks and practical pipeline velocities.

e) Assess the current and future demand for marine petroleum infrastructure by analyzing import and export trends for petroleum products. The basis for this analysis will be the recently completed studies by Stillwater Associates for the Energy Commission, notably the Strategic Fuels Reserve Study, amended where necessary when more recent or more detailed information has become available since the original study was completed last year.

f) Obtain information from the Port Authorities and other involved parties related to existing plans to augment capacity through new projects, or conversely, what existing capacity may be lost in the near future.

g) Evaluate the adequacy of the existing and anticipated capacity as compared to current and future demand.

h) Recommend measures to alleviate eventual shortfalls in infrastructure capability, including next steps and implementation plans, and identify potential barriers to implementation, such as delays in permitting processes.

i) Collect feedback from the industry in an open forum workshop, and adjust where necessary the recommended alternatives.

j) Present the final conclusions and recommendations to the legislature.

Findings

The capacity of logistical infrastructure to handle petroleum products is determined by hard limits as well as softer constraints. Examples of hard limits are maximum throughput of pipelines, draft and tonnage restrictions for berths, and maximum storage capacities of tanks. Examples of soft limits are berth occupancy, volumes handled through tanks, and flexibility of assets for changes in product service. While the hard limits are difficult to overcome and often require major capital investments and long lead times when more capacity is needed, the softer limits translate into gradually increasing scheduling problems and higher operating costs.

In addition to physical constraints, there are a number of commercial developments that restrict access to infrastructure for independent importers of petroleum products, while other commercial factors in the petroleum terminal industry create hurdles for new capital investment. New capacity additions are also hindered by lengthy permitting procedures and land-use policy decisions in the ports.

After a review of hard limits, soft limits and commercial barriers, it was found that the marine petroleum infrastructure in California's main refining centers, the San Francisco Bay Area and the Los Angeles Basin, is significantly constrained in certain key areas and that under current commercial and public policy conditions, it is likely that future demand on the infrastructure will outstrip capacity. In particular, of concern are:

Docks, Berths and Moorings

Marine dock capacity for petroleum products in California is generally adequate. However, several operational constraints, that is, soft constraints that contribute to scheduling problems and higher operational cost, apply to the usage of marine berths for petroleum products:

a) In the LA Basin, approximately one fifth of tanker receipts and shipments of petroleum products are handled at berths that see very high monthly occupancy, at the level where scheduling conflicts become a concern. Pipeline capacity to move product away from these docks constrains further growth in imports. About half of all maritime petroleum volumes in LA are handled at

berths that average at a level that is well within the normal operating range and still leaves some room for growth as long as pipeline capacity is adequate. The remaining 30 percent of dock capacity is operated in a proprietary manner and has additional, unused capacity.

b) In the Bay Area, more than 75 percent of the volumes handled by the refiners pass over docks that are occupied on average between 40 and 50 percent of the time, still within the normal operating range.

c) Capacity in the Bay is constrained because draft restrictions at Pinole Shoals require tankers to be lightly loaded. Shippers have to increase the number of vessels calling at those ports to make up for the lost shipping capacity. Stakeholders are very concerned about the ability of the various government agencies to solve the necessary problems in order to dredge the channels in the Bay to their proper depth.

Pipelines and Tankage

Storage capacity for petroleum products in California is generally tight. In particular tankage that is part of the marine infrastructure, with good access to deepwater docks, is highly utilized.

a) Two of the three large gasoline importing facilities in the LA Basin are constrained by their ability to move product away from their dock, according to Stakeholder input and consultant calculations.

b) In the LA Basin, tankage on average cycles between full and empty (one “tank turn”) once every 15 to 20 days, which is at the high end of normal operating usage. However, it is not uncommon for key tankage to cycle every 3 to 4 days, or up to one hundred tank turns per year. At this level of usage, the tank becomes a physical and operational bottleneck. Refiners reported to the South Coast Air Quality Management District that they are hampered by the lack of tankage in the LA Basin.

c) In the Bay Area, tank usage overall is also at the high end of the normal operating range. Detailed information as to turns of individual tankage was not available for the Bay.

d) Although not quite keeping up with demand, several projects to build new tankage are currently underway, mostly consisting of upgrading and recommissioning existing tankage, or under pre-existing permits.

    1. In the LA Basin, one large terminal operator has refurbished some 600-700 MB of tankage capacity by utilizing existing permits. This capacity has been taken by its refiner parent or by current customers. A small terminal operator, also with existing permits, added two 100 MB drain dry tanks. Another small terminal operator has obtained permission from the Port of Long Beach to build a 50 MB tank. A different large terminal operator, after agreeing to a contract with an independent oil company, has decided to go

ahead and start the permitting process for new tankage capacity at Carson. They expect that the project will take three years to complete.

2. In the San Francisco Bay, a large terminal operator has started construction on three tanks that had existing permits.
3. Market participants report that tankage is adequate in the Bay, but tankage remains very tight in Los Angeles.

Pipeline Gathering Systems

The following physical constraints were identified for the pipeline gathering systems from the terminals and refineries to the head of the common carrier pipeline:

a) The clean products pipeline gathering system in the Bay Area is operating at maximum achievable flow rates in almost all branch and loop lines connecting the refineries and terminals to the main pump stations for delivery into the Kinder Morgan long distance pipelines. This forces market participants to truck products around the bottleneck at Concord, raising the distribution costs of future demand growth.

b) Although less so than in the Bay Area, many of the proprietary line systems that constitute the gathering systems in the LA Basin are constrained in capacity, with only two terminals (and no refineries) capable of supplying into the Kinder Morgan pipeline at the rate required to avoid slow pumping fees.

Commercial Barriers

Significant commercial barriers exist that restrict the usage of existing storage and the construction of new tankage despite strong demand.

a) In the major import center for California, the LA Basin, most tankage is owned or controlled by the local refiners. This is a legacy of the market's traditional role as an exporter of oil. The region has only become a net importer of products since 1999. For gasoline and blendstocks, it is estimated less than 3 percent of available storage capacity is accessible to independent importers. As a consequence, competition is limited because very little gasoline is brought in outside of the refiners' distribution systems.

b) Two refiners do offer commercial storage in the LA Basin. The capacity of one is generally full with term customers. Stakeholders reported that the other has some limited spot capacity, but for fungible products only, no blending components.

c) Both areas have only one independent gasoline importing terminal of commercial significance, ST Services in the Bay and Kinder Morgan in LA.

d) Although current commercial rates for storage offer reinvestment economics to the terminal operators, new capacity additions have not kept up with increased

demand. A number of commercial, financial, and permitting factors have been identified that contribute to the lack of new building. Terminal operators maintain that it takes three years to create new storage capacity – two years to permit and a year to construct.

e) Because supply and demand forecasts can change due to political decisions or due to economic conditions, the lengthy permitting and construction period creates an element of risk that is unacceptable to a number of logistics service providers and their customers.

Forecast Demand for Petroleum Infrastructure

The outlook for the short to medium term, i.e., to 2010, is that demand for marine infrastructure in terms of additional import volumes is likely to outstrip capacity. The primary areas of concern are crude oil and gasoline:

a) For crude oil, a continuing decline of Alaska production at approximately 8 percent per year and the anticipated decline of in-state production at 4 percent per year will call for more imports, primarily from the Middle East. Proposed projects in the LA Basin will improve the infrastructure to effectively meet the increased demand for marine infrastructure capability, while the Bay Area will see increasing cost and risk from offshore transfers from VLCC to smaller vessels. The overall storage capacity for crude oil in California will remain low relative to the potential need to effectively deal with major supply disruptions due to natural disasters or geopolitical events.

b) Imports of gasoline and blending components are expected to double from a level of 150 TBD in 2001 to 300 TBD in 2010. This increase, which primarily affects the LA Basin, will double the number of vessel movements, outstripping the handling capabilities of the current docks and marine terminals, especially when combined with a continued growth in import volumes of diesel and jet fuel. Overall, if the California fuel markets continue to grow at 2 to 3 percent per year while refining capacity only grows at 0.5 to 1 percent per year, between 0.5 million and 1 million barrels of new tank capacity would have to be added every year to maintain the current levels of capacity utilization. Despite some recent new capacity brought on line, conversion or new building is not keeping up with demand.

In summary, the logistics capacity in the Ports of Los Angeles and Long Beach to import products is constrained, primarily by the capacity of pipelines to move product away from highly utilized docks and the availability of inland tankage. Facilities in the Bay are constrained by the lack of dredging of the Pinole Shoals and by pipeline capacity between the refineries and import facilities and the head of the common carrier pipeline. Competition is limited because each complex is served by only one significant independent logistics service provider.

All these point to an urgent need for a coordinated approach between the industry and the state government to address the various constraints that will make California's petroleum supplies vulnerable to higher costs and to supply disruptions in the coming years.